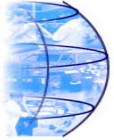


GIS and Disease Surveillance

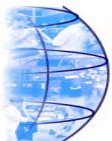
Missouri Department of Health and
Senior Services

Joseph Weidinger, GIS Analyst



Disease Surveillance Data

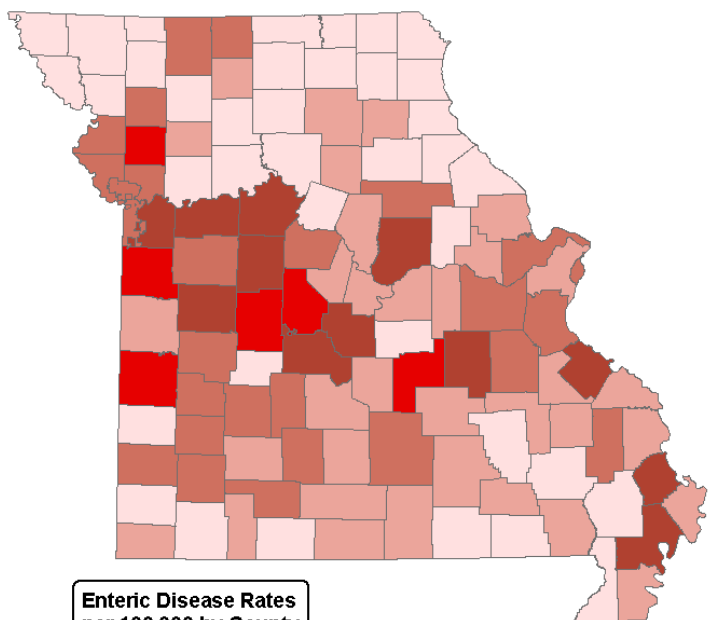
- MOHSIS (Missouri Health Surveillance Information System)
- BTS (Bioterrorism Surveillance)
- Independent Access Databases
- GIS Databases



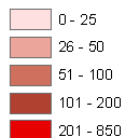
Example: Enteric Diseases



Enteric Disease Rates
1995



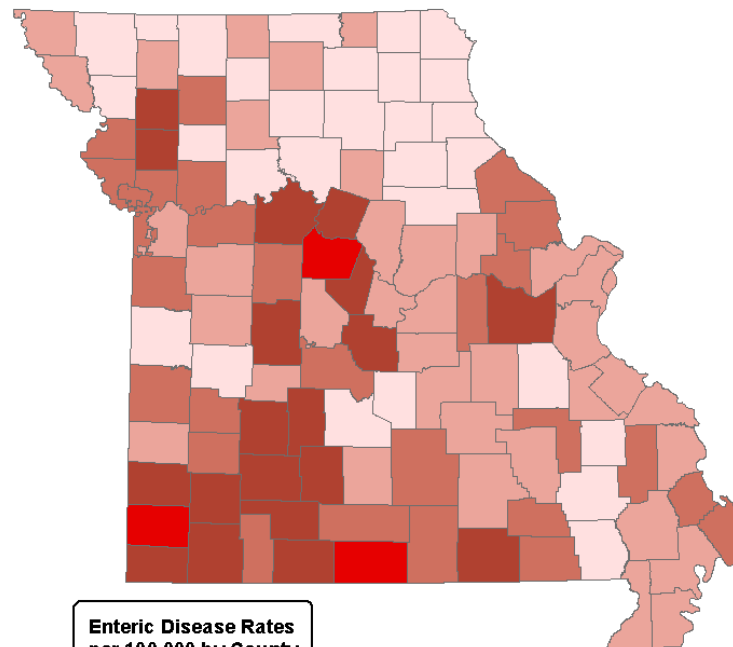
**Enteric Disease Rates
per 100,000 by County**



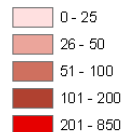
0 25 50 100 Miles



Enteric Disease Rates
1996

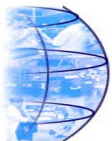


**Enteric Disease Rates
per 100,000 by County**



0 25 50 100 Miles

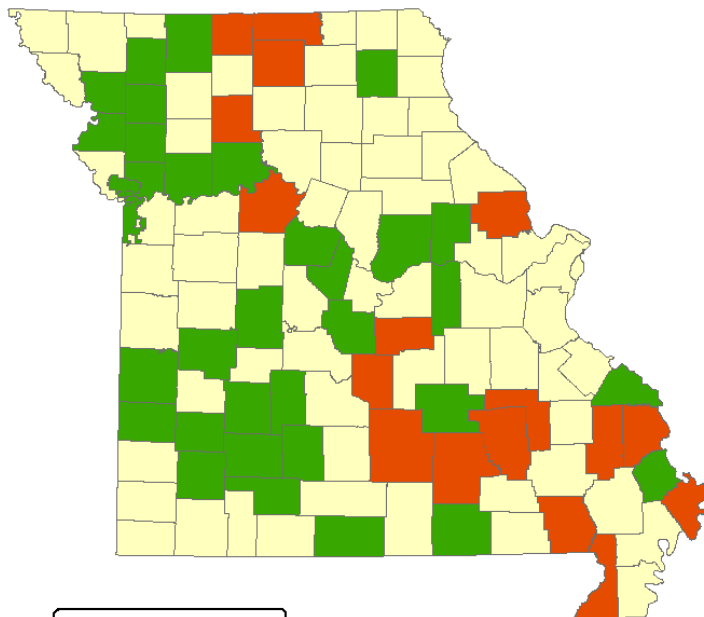




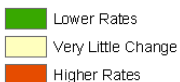
Example: Enteric Diseases



Enteric Disease Rates
5 Year Trend: 1998 to 2002



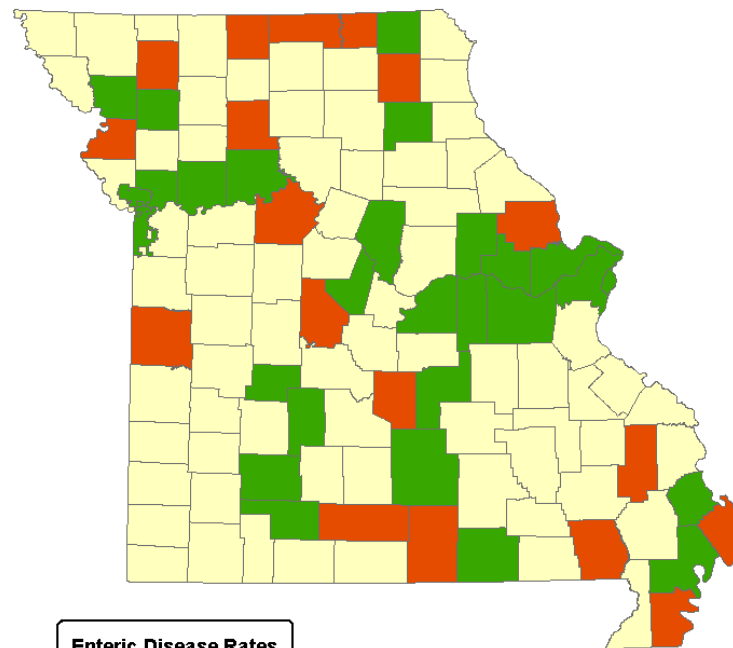
**Enteric Disease Rates
1998 to 2002 Change**



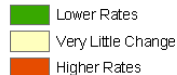
0 25 50 100 Miles



Enteric Disease Rates
10 Year Trend: 1993 to 2002



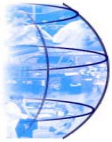
**Enteric Disease Rates
1993 to 2002 Change**



0 25 50 100 Miles



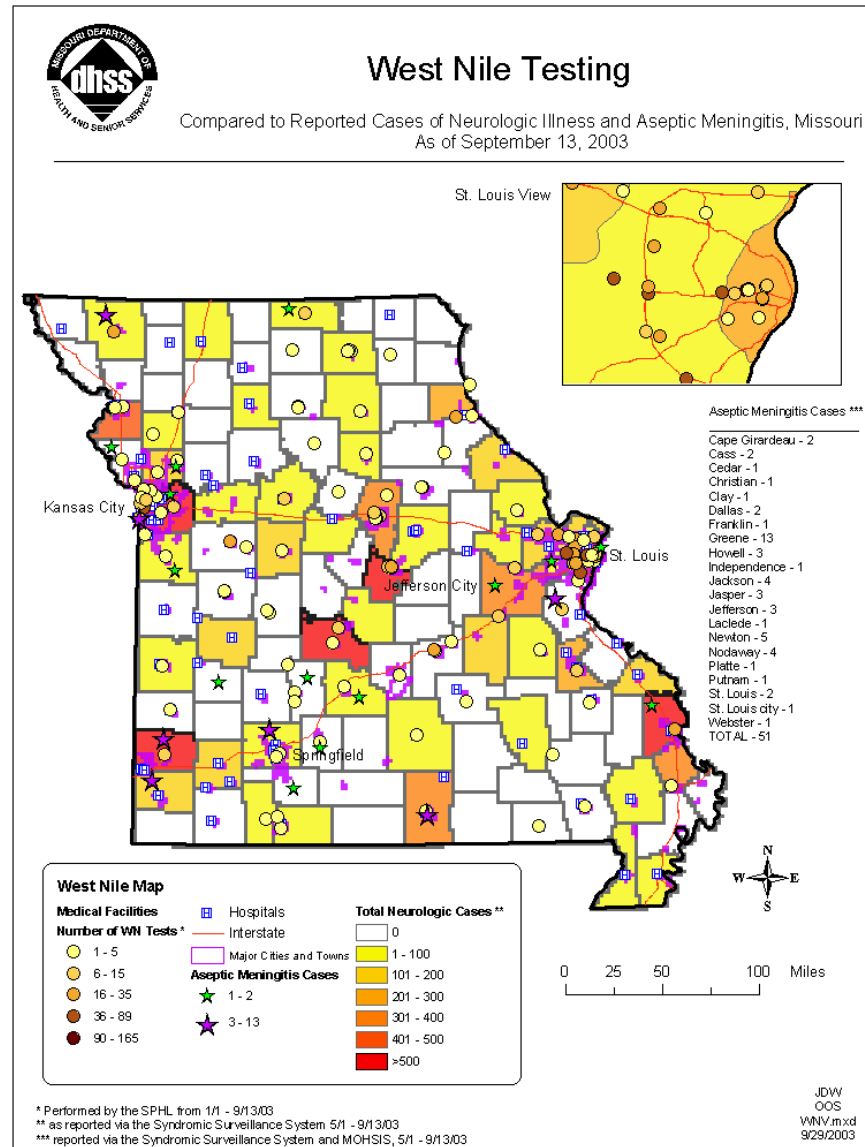
OoS
JDW
11/4/2003



Example: West Nile

GIS to compare
related conditions:

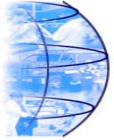
- West Nile Virus
- Neurologic Illness
- Aseptic Meningitis





Influenza Mapping

Weekly Mapping Procedures
Streamlining the Process



Old Maps vs. New Maps

Old Maps

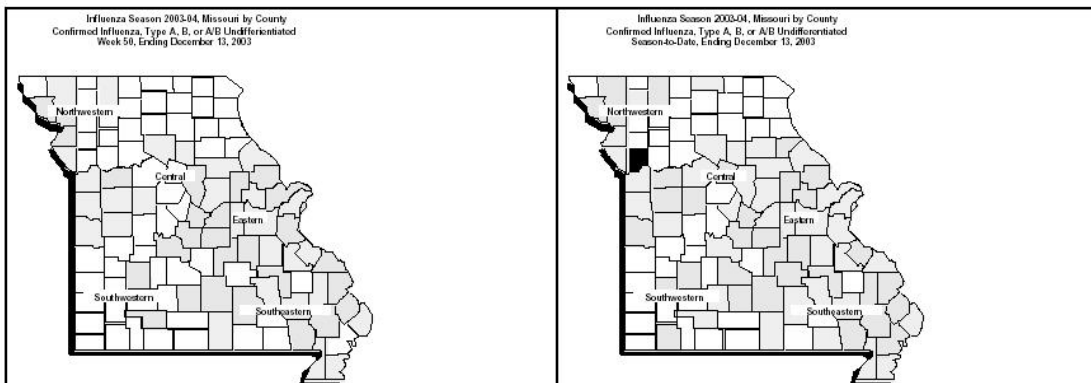
- Performed in Claris Draw by hand
- Time consuming and error prone
- “Ugly maps”

New Maps

- Performed through Access, SAS and ArcGIS
- Much more automated and efficient
- Better Cartography

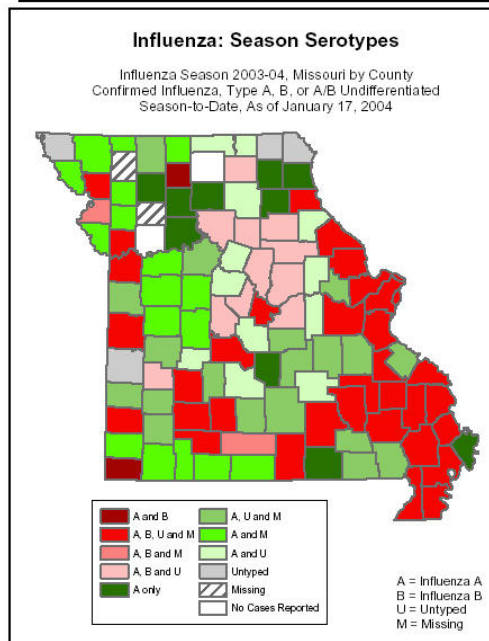
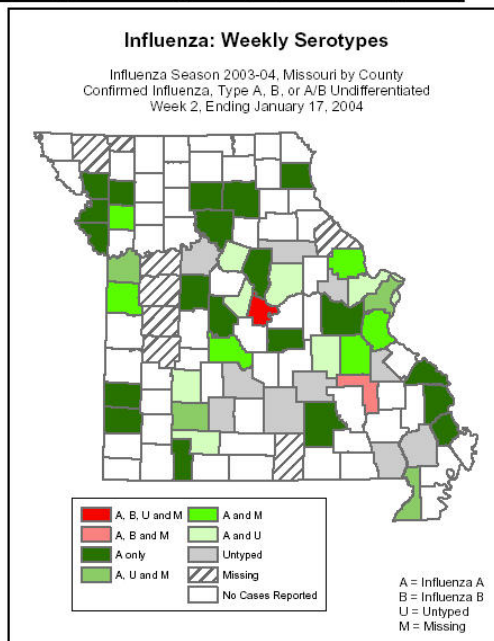


Serotypes



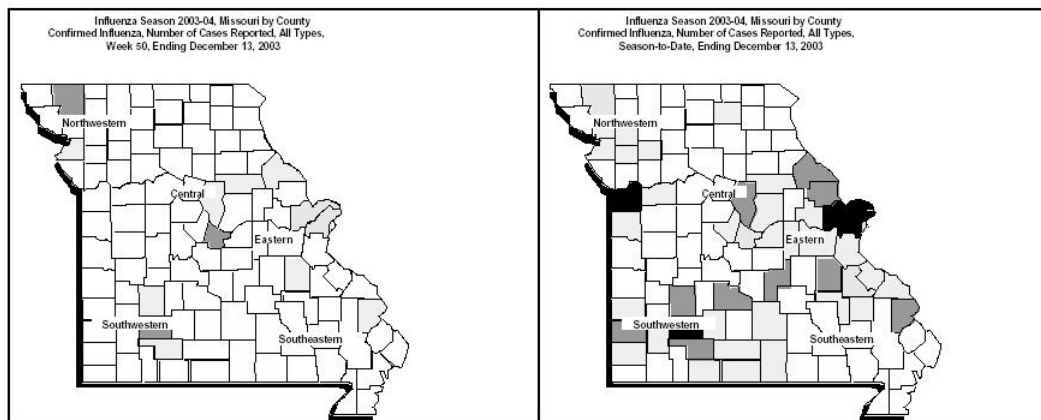
	A and Untyped		A only
	B and Untyped		B only
	Untyped		A, B and Untyped

	A and Untyped		A only
	B and Untyped		B only
	Untyped		A, B and Untyped



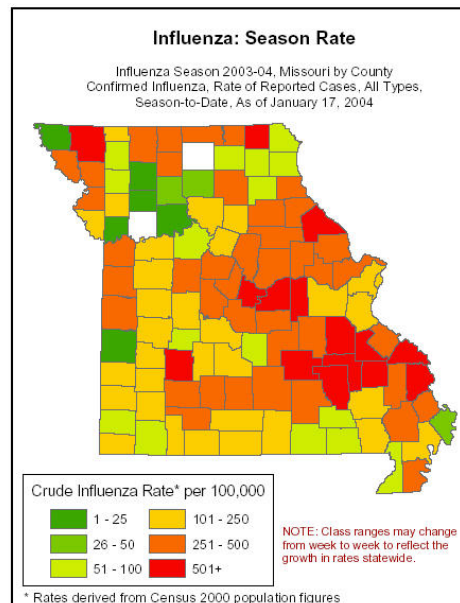
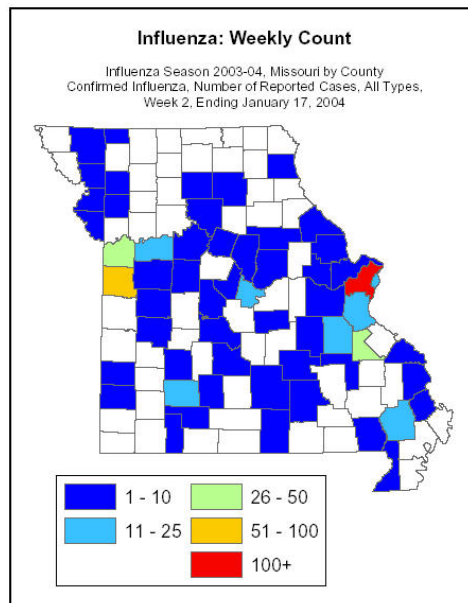


Numbers



	1 - 25		101 - 200
	26 - 50		201 - 300
	51 - 100		300 +

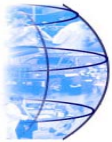
	1 - 25		101 - 200
	26 - 50		201 - 300
	51 - 100		300 +





Preparing the Data

- Download from MOHSIS
- Cleanup and format (county name and disease type)
- Run SAS to summarize for labels
- Run Access query to calculate numbers and rates
- Updates a join table in ArcGIS



SAS Program for Labels

Go from this...

COUNTY	SEROGROUP
ANDREW	INFLUENZA A
ANDREW	INFLUENZA A
ANDREW	INFLUENZA A
ANDREW	INFLUENZA A
ATCHISON	UNTYPED
AUDRAIN	UNTYPED
AUDRAIN	INFLUENZA A AND B
AUDRAIN	UNTYPED
AUDRAIN	UNTYPED
AUDRAIN	INFLUENZA A H3N2

⋮

...to this

County	Serogroup
ANDREW	A only
ATCHISON	Untyped
AUDRAIN	A, B and U

⋮



Access Query for Counts and Rates

Go from this...

COUNTY	SEROGROUP
ANDREW	INFLUENZA A
ANDREW	INFLUENZA A
ANDREW	INFLUENZA A
ANDREW	INFLUENZA A
ATCHISON	UNTYPED
AUDRAIN	UNTYPED
AUDRAIN	INFLUENZA A AND B
AUDRAIN	UNTYPED
AUDRAIN	UNTYPED
AUDRAIN	INFLUENZA A H3N2

⋮

...to this *

County	Count
ANDREW	4
ATCHISON	1
AUDRAIN	5

⋮

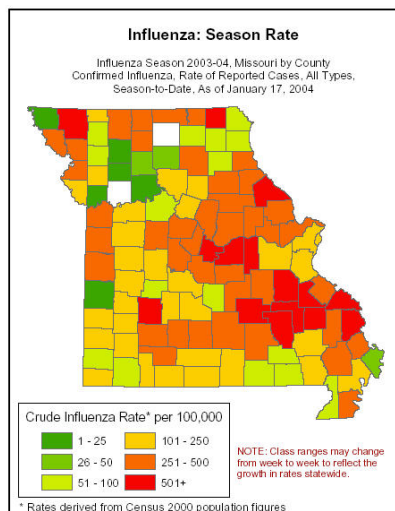
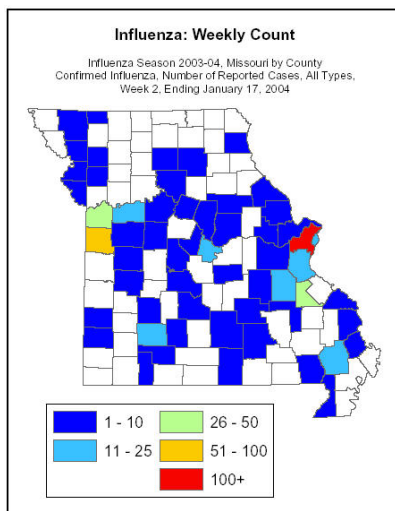
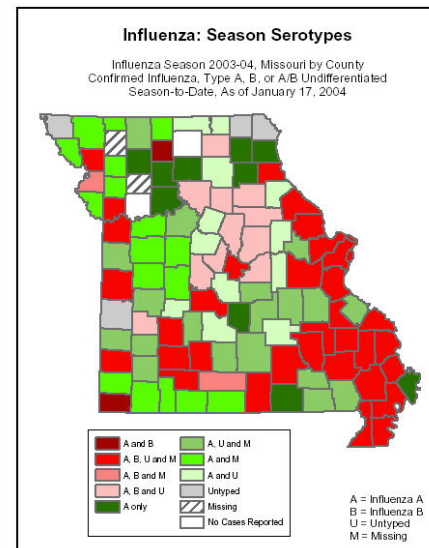
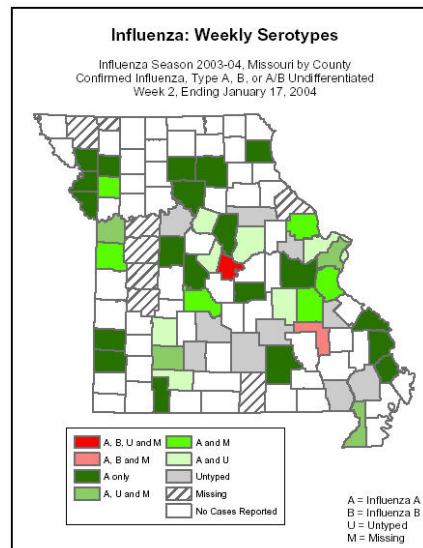
* These numbers can be used to derive rates if run through the right query with population data.



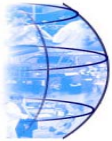
Tables Joined to ArcGIS

- Label field for Serotypes
- Field for Counts
- Field for Rates

Serotypes



Counts and Rates



Serotype Labels

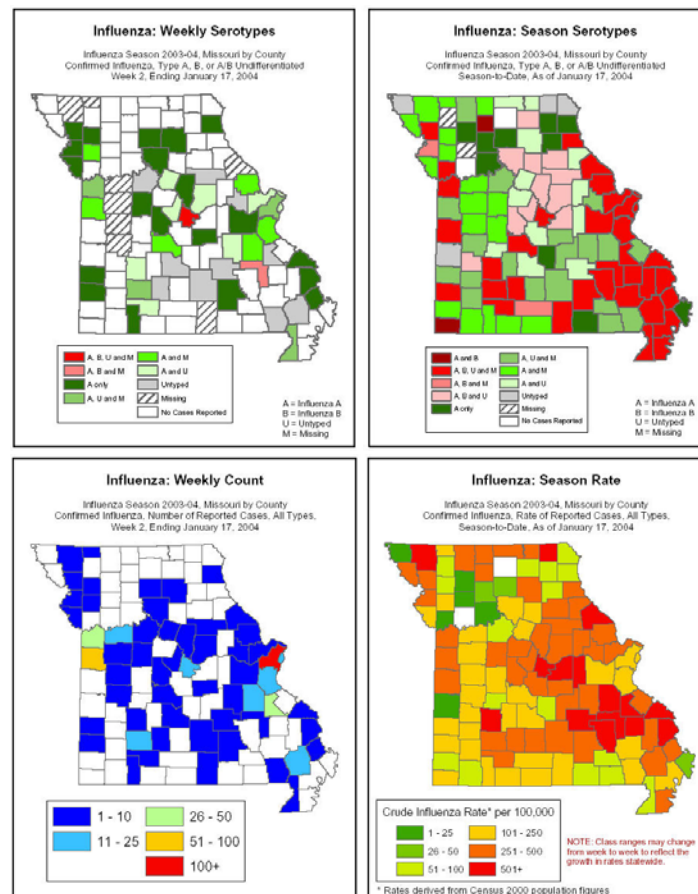
- Rematch to custom stylesheet
- Rearrange the display order

Name	Category
<input type="checkbox"/> <Null>	
<input checked="" type="checkbox"/> A and B	
<input checked="" type="checkbox"/> A and M	
<input type="checkbox"/> A and U	
<input checked="" type="checkbox"/> A only	
<input type="checkbox"/> A, B and M	
<input type="checkbox"/> A, B and U	
<input checked="" type="checkbox"/> A, B, U and M	
<input type="checkbox"/> A, U and M	
<input type="checkbox"/> B and M	
<input type="checkbox"/> B and U	
<input checked="" type="checkbox"/> B only	
<input checked="" type="checkbox"/> B, U and M	
<input checked="" type="checkbox"/> Missing	
<input type="checkbox"/> No Cases Reported	
<input checked="" type="checkbox"/> U and M	
<input type="checkbox"/> Untyped	



Update Text and Export

- Update title and dates
- Export to PDF
- Finished in 15-20 minutes vs. 4-6 hours
- Higher quality maps and less errors





Influenza Mapping Conclusions

- Maps are completed more quickly and with less possibility of human error
- Maps are more readable and convey more information
- Used as a management tool to located those counties where no serotype was identified



Disease Investigation

Cryptosporidiosis In the Kansas City Region



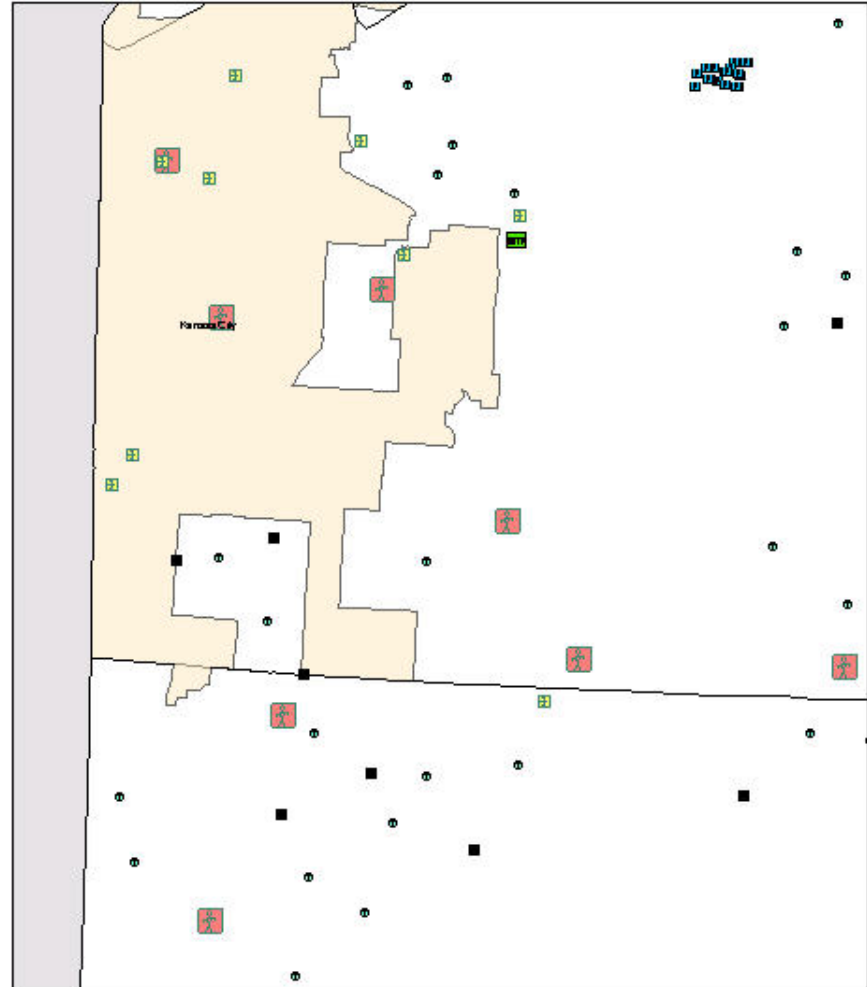
Cryptosporidiosis

- Request from Kansas City area to investigate
- Perceived high number of cases
- Question 1: Where are the cases?
- Question 2: Could a single water source be the cause?



Mapping Cases and Water Supply

- Recent Cases*
- Various water supply types
- Cases are well dispersed, no obvious central tendency
- Cases in a two county area

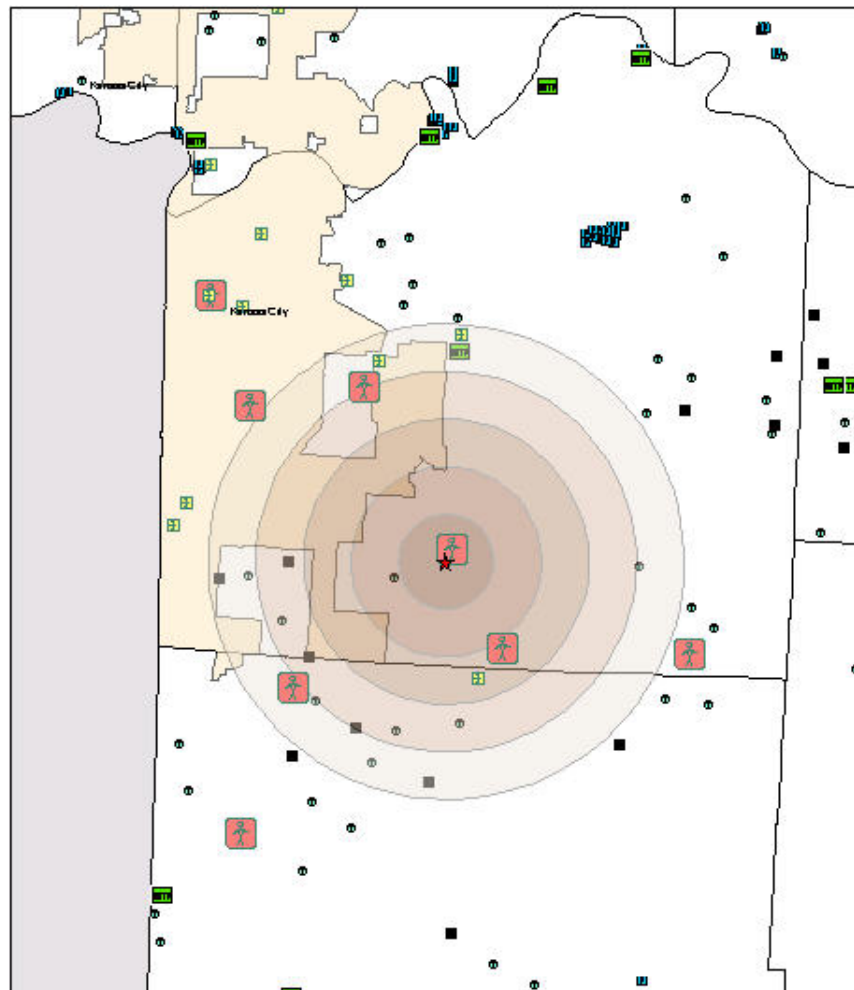


* Case locations have been shifted to protect patient confidentiality



Center of Outbreak

- Center of recent cases*
- Buffer (2 mile intervals)
- Water supplies near center?
- Nothing within 2 miles
- Nothing conclusive

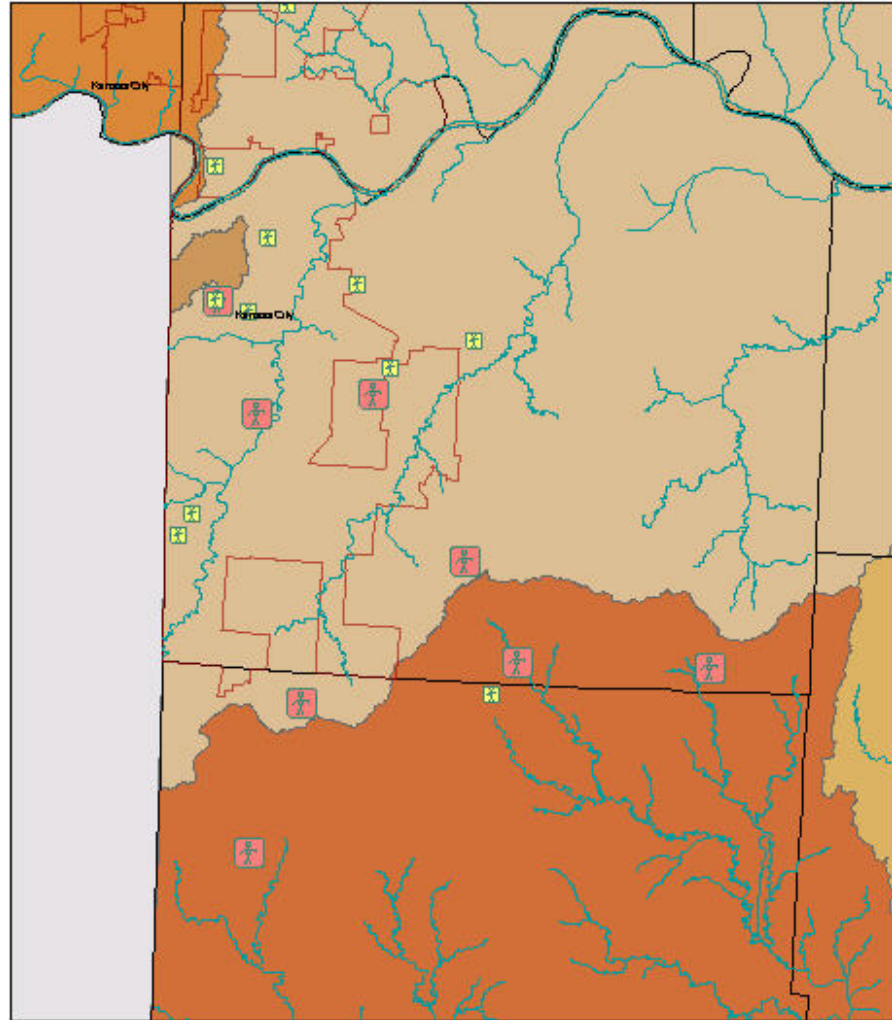


* Case locations have been shifted to protect patient confidentiality



Cases and Watersheds

- Cases* overlaid with watershed boundaries
- Cases fall in three different watersheds
- HUC 8 Watersheds

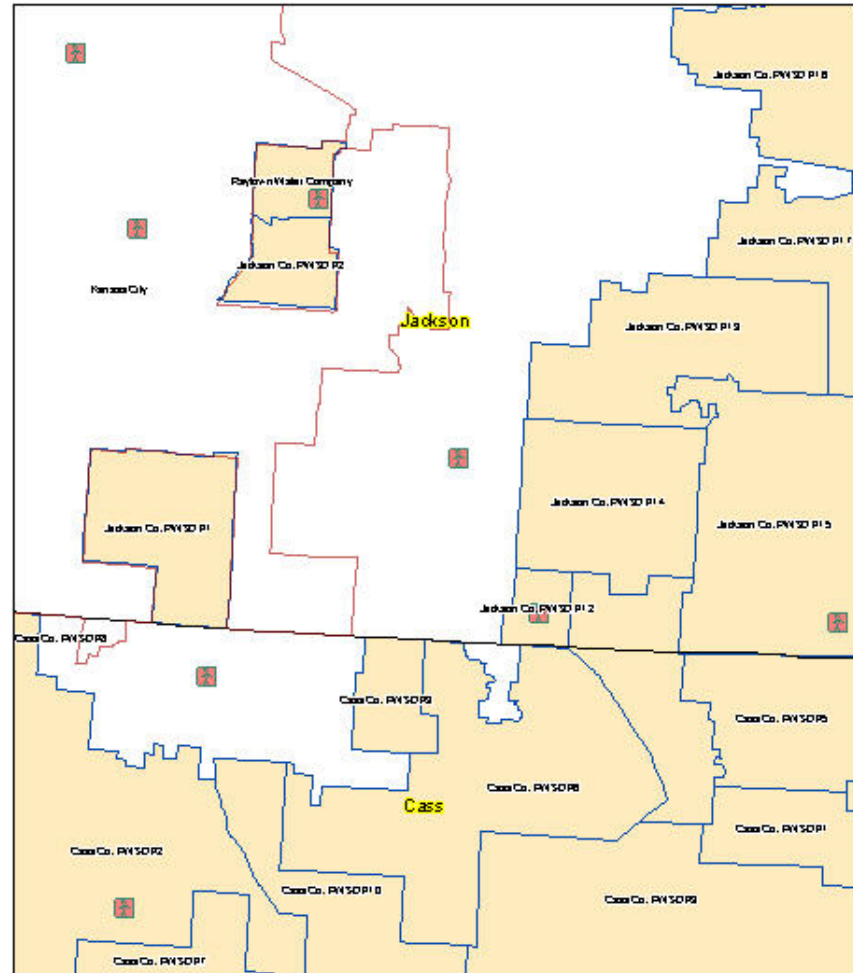


* Case locations have been shifted to protect patient confidentiality



Cases and Water Districts

- Case locations* and Water Districts
- Water District data incomplete
- Enough to determine the cases fall within several districts

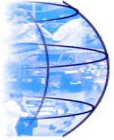


* Case locations have been shifted to protect patient confidentiality



Cryptosporidiosis Conclusion

- Maps revealed nothing suspicious as a single source
- Information about where the people worked or socialized would be best, but that is not available
- Other common factors, such as drinking the same bottled water?
- After further comparison, case rate was not above normal levels for that area and that time of year



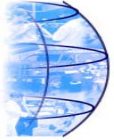
Bioterrorism Surveillance

Tracking Syndromic Information with
ArcGIS Tracking Analyst



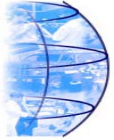
Bioterrorism Surveillance (BTS)

- Syndromic data collected daily from participating sites (hospitals, clinics, schools, etc.)
- Database is in Microsoft Access
- Participation is voluntary
- Reports and summaries are routinely generated
- Mapping components are being developed



BTS and Tracking Analyst

Application demonstration...



Future Directions and Ideas

Making mapping more integrated,
automated, and providing better
analysis



Future Directions: Enterprise

- Enterprise databases and ArcSDE
- ArcIMS and greater distribution of maps
- Linking these and desktop GIS with other databases



Future Directions: Automation

- Scripts, SAS, Access queries, ArcObjects, etc.
- Data standards and data consistency
- Greater efficiency and accuracy
- Enhanced and timely information for decision makers and investigators



Future Directions: Analysis

- Relative or probability rates rather than raw rates, comparing data to baseline or threshold values
- Rate smoothing for small and large number bias
- Spatial autocorrelation and cluster analysis to identify specific areas of concern (available with ArcGIS 9.0?)